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Wage Bargaining Coordination and the Phillips Curve in Italy

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1. Introduction

After dominating the policy agenda across the 1970s and the 1980s, two decades of apparent price stability have confined the dynamics of inflationary processes to the outer limits of the macroeconomic debate. This appears short sighted in the light of recent developments. First, history teaches us that two decades are just a blip on a long-run perspective. The current rise of inflation in the US, UK and the euro area suggests that inflation is far from dead, even now that the US economy is slowing and growth has decelerated in many other advanced countries. It is then time to reconsider the relevance of inflation and not only in its role for policy choices, as many aspects of past inflationary processes are still unsettled. Past spells of low inflation could guide us in interpreting the current state of affairs and identifying those forces that transform low rates of inflation into higher rates. This paper intends to contribute to the debate on these issues by investigating the evolving nature of the trade-off between inflation and output in Italy.

We examine Italian inflation rates and the Phillips curve with a long-run perspective, from the end of World War II to the entry of Italy in the European Monetary Union (end of 1998). Italy, as a case study, has two attractive features. The first is that this country has experienced higher than average and more volatile inflation rates than most industrialized countries and across a variety of monetary regimes. The second is that Italy differs from Anglo-Saxon market structures and institutions, whereas the bulk of the literature on the Phillips curve has concentrated mainly on those countries. The long reach of our study appears to be particularly suitable to draw novel inferences.

Methodologically, this study first examines the volatility, persistence and stationarity of the Italian inflation rate over the long run and across various exchange-rate regimes that have shaped Italian monetary history (Fратиanni and Spinelli, 2001). Next, we estimate alternative Phillips equations and capture the effects of structural changes and asymmetries on the estimated parameters of the inflation-output trade-off, relying partly on sub-sample estimates and partly on time-varying parameters estimated via the Kalman filter. Finally, we include the US and the UK in our estimation exercise for comparison purposes.

The main results are as follows. The level, volatility and persistence of inflation display significant fluctuations over our sample. Fixed exchange rates are associated with lower inflation rates than more flexible forms of exchange rates. Bretton Woods stands out as the only major non-war inflationary period. Inflation persistence is higher under flexible exchange rates. Non-stationarity of inflation appears to be a feature of flexible exchange rates. This evidence supports the view that institutional changes like in the wage bargaining structure and in indexation mechanism had a significant impact on the behaviour of inflation over time.

As to the inflation-output trade-off, *inter alia* we provide estimates of a consensus model that blends the original expectation-augmented Phillips curve with the most recent stylizations on persistence and price/wage rigidity (Woodford, 2003). Over our sample, we are not able to detect a statistically significant, textbook-like feedback from cyclical conditions to inflation, suggesting dominance of supply-side factors such as the degree of goods and labour markets regulation and of inflation expectations.

2. Inflation in Italy, 1949-1998

2.1 Stylized facts

There are several measures of the Italian price level over the time span considered in this paper. For instance, Spinelli and Trecroci (2008) gather time series of the implicit price deflator of national income, cost of living and wholesale prices, dating back to 1861, with Italy's unification. In this paper we pick up the former, but experiments with the other indices show that most of our findings are qualitatively unaffected by the choice we make. The sample period spans 1949-1998 and data are at annual frequency.

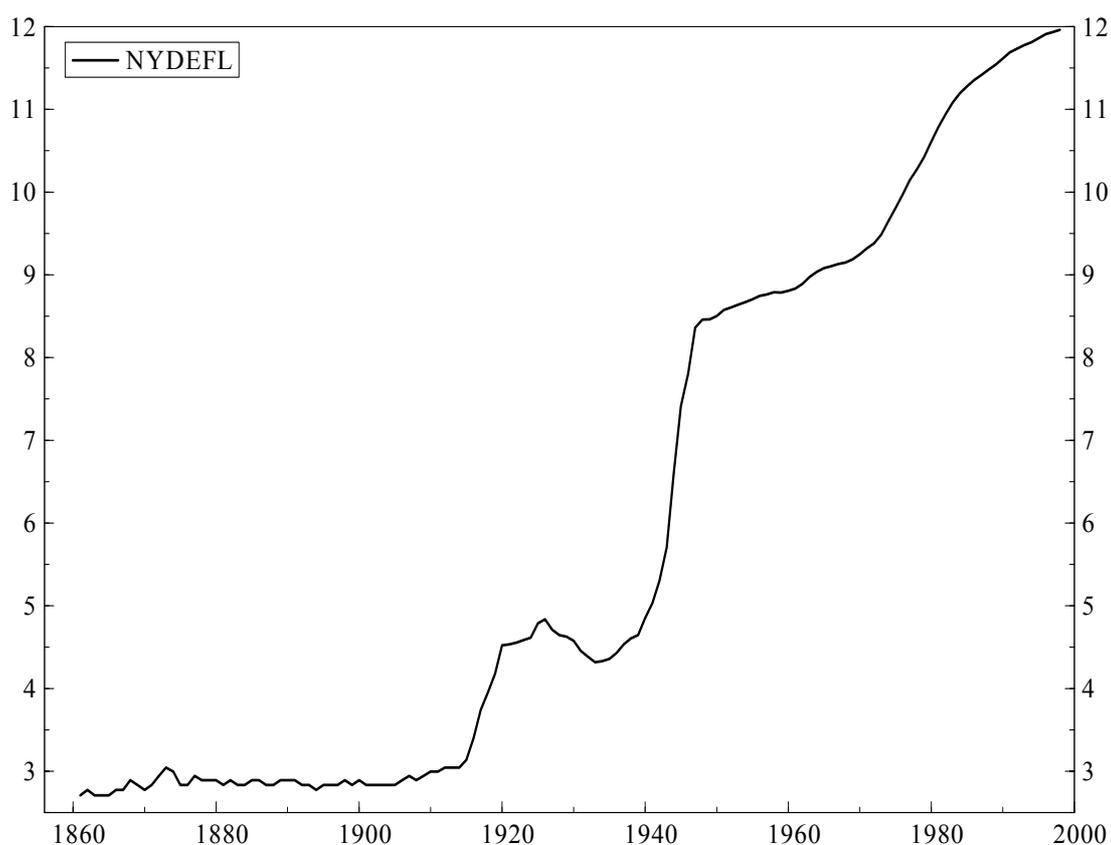


Figure 1, Italy, 1861-1998: implicit price deflator of the national income, natural log of index.

Though we focus our attention on post-war period, we feel that plotting the price level over the century 1861-1998 gives the appropriate historical background to our study. Until WWI, the series displays some limited variability around the 50-year average. With WWI, prices underwent a sharp increase, which levelled off only in the mid-20s. Later in the interwar years, Italian prices experienced a deflationary tendency, reversed with a second, and more acute inflation outburst, which characterised WWII and the post-war years. Between 1947-48 and the early 1970s, the price level kept growing but a more moderate pace than during the wars. However, in the 1970s-90s Italy witnessed a third inflationary process, the only and most significant occurring during peacetime.

Figure 2, below plots the log differences of the price deflator, for the sample 1949-1998. Three sizeable developments stand out: sustained volatility in the 1950s and 1960s, the sharp acceleration apparently stemmed by the first oil shock, the gradual reversion to moderate rates in the latter part of the sample, completed only with Italy's entry into

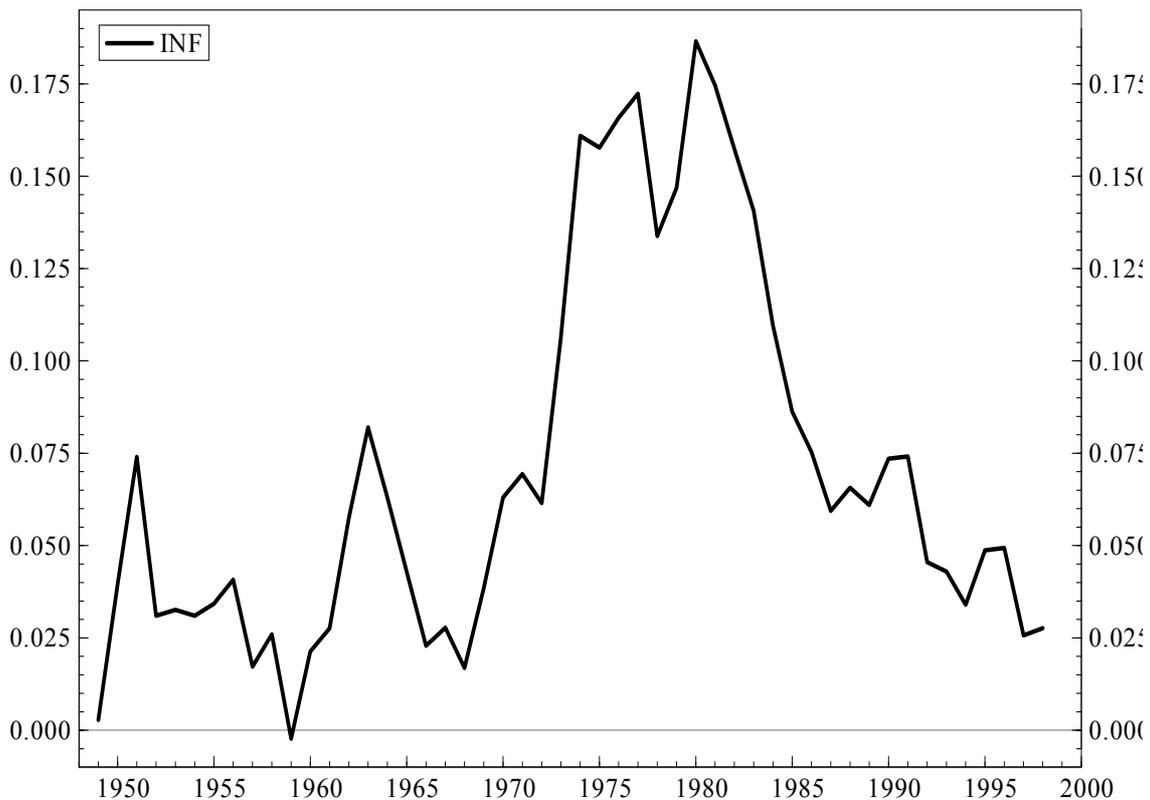


Figure 2, Italy, 1949-1998: implicit price deflator of the national income, change in the natural log of index.

EMU. Given such behaviour, it is interesting to evaluate the stationarity and serial correlation properties of the series, which we investigate below in Section 3, after a full depiction of wage bargaining conditions in Italy over the years we study.

2.2 Wage indexation in post-war Italy

More than in other countries in Italy institutional factors contribute to explain inflation. The first wage indexation mechanism, *indennita caro viveri*, was enacted immediately after WWI. It will be known as *scala mobile* (SM henceforth) and was established for the province of Milan in 1944 and extended in 1945 to protect wages from high inflation: consumption good prices were up by 775,2% between 1943 and 1945. The Employers' Association was willing to accept it to prevent social conflict and the consequences of poverty. This indexation system had no exact counterpart in other industrialized countries and resulted from the favourable bargaining positions of workers and left-wing parties in 1945.

In 1946, the indexation mechanism was extended to Northern Italy, and soon after to the

whole country, following a national agreement signed by the unions and the Italian confederation of entrepreneurs. Initially calculated on a province basis, *scala mobile* was the same for all categories, only differenced by age and sex. The idea of signing something provisional, *contingent*, proved wrong in the following years as *scala mobile* became the symbol of the union power. Blocked in 1946, was re-established in 1951, with a unified index for the whole country for all workers but with a “contingenza point” of 1% of wage levels differenced by qualification, age and sex and company size. The compensation varied according to a “union” cost of living, which recorded the increase in the cost of living for a manual worker family based on price changes of primary consumption goods. In 1957, the *contingenza points* for the manual worker were 396 lire (1% of a pay of 39000 a month), and for a white collar was 948 lire.

In the fifties, a weakened union with a declining membership was progressively excluded by the institutional and government action (Accornero, 1992). Collective bargaining was not widespread nor respected. Still, as we have seen, the *scala mobile* mechanism made some progress, but the inflation and the degree of indexation was still much less than it will be after the 1975 agreement. For employers, indexation appeared as an automatic protection against wage claims: it kept worker’s consumptions above poverty level, maintained social conflict under control and away from factories.

The occupational growth of the sixties in the industrial and services sectors with agriculture beginning to decline, increased considerably union membership. In the industrial sector, employment grew, but slowly because of a relatively high productivity in the North.

Unions extended their control on unskilled workers, whose percentage was growing relative to their old skilled workers traditional base (Cella and Treu, 1982). By the end of the decade, a new collective identity emerged: the unskilled manual workers who migrated from the South and agriculture and were employed in the production chains in the Fordist plants of the North. At the beginning of the seventies, the “working class” reached its peak: blue collars were 84% of employees. This explains their strength, the explosion of massive strikes in the following years as well as the egalitarian wage policy. In 1963, after a series of wage bargaining rounds, real wage increases and under the pressure of a balance of payments crisis, monetary authorities reacted with restrictive measures. Wage moderation followed for only a couple of years along with

the first proposals to adopt centralized bargaining and income policy of the northern European type.

At the end of the sixties, most industrial countries followed two types of patterns to face union unrest and to govern industrial relations: regulation through the market or through politics, what will be labeled “political exchange”. In Italy the level of conflict was the highest among OECD countries: after years of decline and division, unions had strengthened enough to unite into a Federation and push for a unique industrial relation system in Europe: a national level category, plus company level bargaining with strong egalitarian claim that converged in the *SM* indexation mechanism.

The wages of Italian workers were then determined through a centralized system whose mainstay was the national agreement between the confederations of trade unions and the association of entrepreneurs. This agreement set minimum contractual wages for employees at different skill levels in each industry, which covered both unionized and nonunionized workers. Along with category, the centralized component represented by *scala mobile* held firmly at the centre of the bargaining process with plant level developing along with the union presence in large private and public companies.

All wage levels were automatically adjusted by the *Scala Mobile*, which ensured until the early 1990s, automatic rises in wages in the face of inflation. The *SM* was the most representative phenomenon of those years, at the top of the economic and political agenda for the years '75 -'85. At the end of 1974, the *SM* coverage of real wages was consistently lower than the full real indexation of 1957 *SM* agreement and the gap between manual and clerical workers had widened. When the cost of living increased by 1%, a manual worker earning 160.000 Lire a month should have received 1.600 lit to fully protect his wage. But the index had reached 252 points, the manual worker received 2,52 *contingenza* points, that is to say, 998 Lire (396x 2.52) the point being at 396 Lire for the manual and 948 Lire for a clerical worker. To overcome this disparity, the value of *contingenza* point was revised in 1975 with a historical bilateral agreement. Unions and employers, after a long debate agreed to fix a unique *contingenza* point for all workers equivalent to the highest (948 lire of a 1st level clerical worker), plus a “heavy point”, of 2.52 times the predetermined point of 2.389 Lit for all industrial workers to face inflation accelerating due to the oil crisis. The index was again set to the new base 100.

The Lama-Agnelli agreement represented for Italian unions the most rewarding victory but at the same time, it marked the beginning of its decline in the following years. The benefits in terms of inflation and social peace were short lived. Soon the base itself of the scala mobile mechanism that had reached its top recognition started crumbling apart. The Agreement had been considered acceptable by Gianni Agnelli in 1975, to keep the conflict outside his factories and sedate the massive turmoil. Unions saw an automatic mechanism as the best reward to offer to their base, instead it deprived them of any room for manoeuvre in their wage policy, but they were not the only ones to be negatively affected. In fact it also reduced the scope and range of action of economic policy. The indexation connected with consumer prices protected wages also from increases in imported goods, de facto importing foreign inflation. Exchange rate policy was made less effective and socially very expensive as it was born by the most vulnerable groups who were less covered by indexation. These effects pushed inevitably the government to take direct action in the political exchange, transforming the bilateral into a trilateral process of bargaining.

As a consequence of the 1975 pact, the percentage share of earning increases due to indexation, grew much faster than the one due to contractual increases: the *scala mobile* was rapidly eroding the union's power as a wage regulator (Somaini 1989).

Tab. 2. percentage share of wage increases due to *contingenza*

1970	13,5
1971	12,5
1972	18,0
1973	19,9
1974	18,1
1975	24,5
1976	48,1
1977	66,7
1978	74,1
1979	79,7
1980	66,4

Fonte: Somaini 1989: Tab. 9.6

The degree of coverage of real wages, inversely proportional to its level, the higher the income, the lower the coverage, inevitably flattened wage¹ differential and shook the

¹ To give a quantitative idea, Manacorda(2004), considers two individuals at the top and bottom deciles of the earnings distribution in the first quarter of 1978. Their monthly wages in December 1977 were, respectively, 461,000 Lit and 192,000 Lit, and therefore the relative wage was 2.40. The SM point was approximately equal to 2,400 Lit. From January to April, the price index increased by 5 points, triggering

whole earnings structure. By granting the same absolute wage increase to all employees as prices rose, SM had a considerable equalizing effect and was largely responsible for the fall in inequality between the late 1970s and the mid-1980s. (Manacorda (2004) After the strong compression in the late 1970s, beginning in the mid-1980s, wage inequality restarted to increase². This posed a threat to the ability of the union to control its centralized power and its stabilization strategy based on political exchange.

Every reduction in the rate of unemployment maps an increase of the monetary wage rate in 1970, '73, '76, overcoming the average labour productivity growth (4-5%) to such an extent to generate a 20% increase of inflation, even in presence of restrictive monetary and fiscal policies. But until 1980, trade unions seemed incapable of departing from the tradition of high level conflict strategy: 20% inflation and a deeply changed economy (large companies reorganization, SME, stagflation) did not induce a change in policy. When faced with the first proposals from Confindustria and the reformist wing of the union, UIL (Benvenuto), CISL (Tarantelli), to control SM, CGIL (Lama) came out with a tax reduction that simply shifted the burden of slowing the growth of labour costs on public expenditure. In 1980, an estimated 40,000 white-collar workers (*quadri*) manifested their dissent against the equalizing effect of the SM in front of the FIAT headquarters in Turin (*Marcia dei quarantamila*). The growing dissatisfaction later induced the government lowered the value of the SM points. The most significant steps in this direction to fight inflation were the agreements of the following years. In 1981 the proposal of Ezio Tarantelli, and CISL did not convince CGIL and communist component who persevered in their intransigent approach: the *scala mobile* was untouchable.

According to Bordogna's (2003), the cycle that had started with the new collective identity of unskilled workers emerging in union representation in the late '60 ends with new groups of workers employed in key sectors (pilots, teachers, transportation

a rise in everybody's wages of approximately 12,000 Lit (5#2,400) and reducing the gap to 2.32. Because of the SM, the relative wage would have decreased by 3% in only 3 months.

² The potential equalizing effect of the SM declined over time, not only as the effect of a fall in inflation (from 14.82% between 1977-1980 to 5.43% between 1989 -1993) but of a number of policy reforms enacted in the following years.

workers, various cobas) seeking representation and fighting against the flattening of income differentials imposed by the *scala mobile*. This pushed the IR system towards dispersion and decentralization. In spite of these resistences to change, moral suasion and pressures by the Bank of Italy were made such that ex post indexation was replaced by ex ante target inflation, whose credibility should have been supported by monetary policy and the pace of the adjustments of the *scala mobile* should be reduced.

The Accordo Scotti in 1983 is the first important breach in the unions unity and the last agreement signed by the 3 unions together: it reduced *scala mobile* by 15-18%. It is also the first to be signed by 3 actors: unions, employers and government. But the final demise of SM was achieved by Craxi on april 14, by isolating the left and winning over the PCI after long struggle. It was the first socialist government to challenge the PCI who was at opposition, on the common ground of the industrial relations system (Bordogna, 2003). The reduction of 4 points in the *scala mobile* for 1984, was accepted by CISL, UIL the socialist wing of CGIL, as well by Confindustria.

The contingenza connected with 8% target inflation, even managed to overcome a referendum promoted by PCI. 1985 is in fact a second milestone in the history of the SM (Manacorda,2004): the proposition (*referendum*) called by the Communist wing of the unions (*CGIL*) to recoup lost increments was defeated. The idea of predetermination of contingenza points was due to Ezio Tarantelli, who was be killed by Red Brigades soon after in 1985. This agreement was signed in a weak labour market in a recessionary phase when unions were very divided and Confindustria threatened to unilaterally stop SM. The Spadolini experiments of governments of *solidarietà nazionale* ended and PCI went back to the opposition. As the *scala mobile* mechanism was going into pieces the union accepted a new bargaining action based on target inflation.

From then until 1986, SM increments were based on some approximation of the SM point and the increments were gradually lost. In 1986, a major reform of the SM established a semiproportional adjustment of wages to changes in prices, which further reduced the potential equalizing effect of the escalator. The reform was partial and ineffective: a more definite settlement was necessary in the early '90s, after Italy entered SME narrow band and joined Maastricht Treaty.

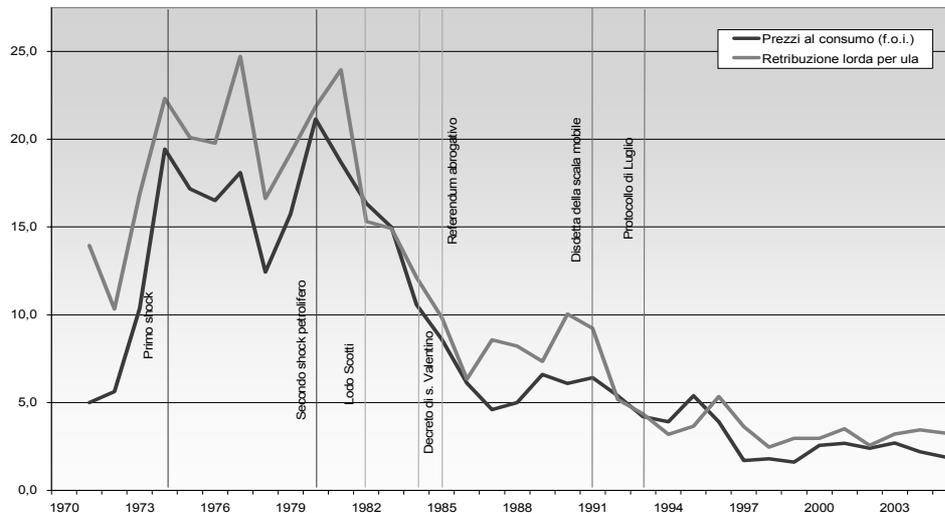


Figure n

Source: Istat, Consumer Prices, Gross Earnings National Accounts (Tronti 2008)

In 1991, the SM was repealed by the Employers association. The definitive solution, arrived with the Trilateral agreements in 1992 and 1993, putting an end to the *SM* long lived experience. The *concertazione* and income policy model took the stage and became institutional with the historical July 1993 trilateral pact. Since its full operation in 1994 this pact has linked contingent wage changes to expected inflation, and performed beyond expectations for a decade. Nominal wage growth has been very moderate with a reduction of the average real earnings. Yet one of the points signed was to review it after 5 years. In spite of the virtual attempts, during D'Alema government, this reconsideration of the pact is still high on the agenda but waiting to be done.

The 1993 pact did not only boost productivity and growth because it never was completed, but because it was laid on an imbalanced ground: at the macro level, the asymmetry between product and labour market deregulation had perverse effects on income distribution and growth. (Tronti, 2008) Since the mid 1980s Europe has gone through labour market deregulation, at least in the sense of a decrease in the bargaining power of workers. The effects of labour market deregulations dominated those of product market deregulation which took place mostly at the end of the 1990s, after the major decline in the labour share (Blanchard Giavazzi, 2003). Without a competitive pressure on prices and profit margins, labour share declined, allowing companies to

postpone investments to improve productivity. High price dynamics reduced wages bargaining power and consequently domestic demand.

In the meanwhile, plant level bargaining which was timidly included in the 1993 pact (*premio di risultato*), has not developed, failing to boost a dramatically declining Italian productivity and wage flexibility. This development would have been crucial now that new labour contracts have been signed thanks to increased flexibility; new technologies elapse union's control and new contractual agents that have emerged; private agencies could propose bargaining conditions to companies. Union's role itself is threatened by the general reduction of membership and of national centralized bargaining losing momentum as new inflation threats appear.

3. Statistical analysis of Italian post-war inflation

We next try to summarize the statistical properties of the Italian inflationary processes, by focusing on the whole span 1949-1998 but also by splitting the sample almost in half in 1973 and studying the resulting two sub samples, as defined by the monetary and exchange-rate regimes Italy adopted over the period under scrutiny. In particular, 1949-1973 saw the adoption of fixed exchange rates within the Bretton Woods system, whereas over 1974-1998 exchange rates essentially followed a “fixed but adjustable” peg.

Table 1 displays average inflation rates (μ), their standard deviations (σ) and variation coefficients ($cv = \sigma / \mu$) for the whole sample and the two sub periods.

SAMPLE	$e_1=7.13^*$; $e_2=22.6^{**}$		
	μ	σ	cv
1949-1998	7.00	5.12	0.731
1949-1973	4.269	2.423	0.568
1974-1998	9.902	5.334	0.539

Table 1, Italy. Implicit price deflator of the national income, change in the natural log of index. Average (μ), standard deviation (σ), coefficient of variation (cv), normality test. ‘**’ indicates rejection of the null with a 99% confidence interval.

The post-Bretton Woods era of fixed but adjustable peg emerges as the period with highest and more volatile inflation, although adjusting the standard deviation for its mean reveals greater relative variability during the ‘50s and ‘60s. Table 1 also contains the results of Jarque and Bera (1987) (e_1) and Doornik and Hansen (1994) (e_2) tests for normality. Essentially, these tests evaluate whether asymmetry and kurtosis of the series correspond to those of a normal distribution³. Table 1 shows results for the whole sample: there is clear evidence against the null of normality. As to stationarity, we employ the Augmented Dickey-Fuller (ADF) test, which we remind is implicit in the evaluation of the t-statistic t of the $\hat{\beta}$ coefficient in:

$$\Delta\pi_t = \alpha + \mu\tau + \beta\pi_{t-1} + \sum_{i=1}^n \gamma_i \Delta\pi_{t-i} + u_t,$$

where τ is a deterministic trend. A significant statistic would imply rejection of the null hypothesis of unit root ($H_0 : \beta = 0$) and therefore stationarity of the inflation rate.

Table 2 presents results for the whole sample and the four main sub periods. We included t -values for the β coefficient for both the model with a constant and that with constant and trend, each estimated with $n = 3$ ⁴.

INFL	Constant				Constant and trend			
SAMPLE	$i=0$	$i=1$	$i=2$	$i=3$	$i=0$	$i=1$	$i=2$	$i=3$
1949-1998	-1.731	-2.100	-1.421	-1.389	-1.757	-1.839	-1.276	-1.259
1949-1973	-2.004	-1.571	-1.406	-1.154	-2.292	-1.823	-1.807	-1.548
1974-1998	-0.4841	-0.9693	-0.6881	-1.207	-3.719*	-3.690*	-3.374	-3.582

Table 2, Italy, various sub samples. Implicit price deflator of the national income, change in the natural log of index. Augmented Dickey-Fuller test Augmented Dickey-Fuller. ‘**’ and ‘*’ indicate rejection of the null with a 95 and 99% confidence interval, respectively.

Overall, inflation appears to be nonstationary: the null of a unit root is accepted in both models usually at a 1% significance level. However, the nature and frequency of the structural changes that lead to nonstationarity cannot be determined with unit root tests. Moreover, the ADF test has low power in small samples and with variables containing MA components (see Maddala and Kim, 1998). This would suggest focusing

³ We remind that Jarque and Bera’s test has low power in small samples. Doornik and Hansen’s test adjusts for this bias.

⁴ The critical values for this procedure depend on the inclusion of the constant or of the constant and a trend term. The critical values we employ are those of MacKinnon (1991). A statistic significant at the 5% is identified by *, at the 1% by **.

on structural breaks rather than on the unit root properties of the series. However, we believe it more appropriate to study the structural changes of the inflationary process jointly with output dynamics, within the context of the Phillips curve.

4. Italian inflation and output in the post-war years

In the light of the above results, it appears crucial to be able to disentangle the temporary components of the inflation process and its long-term, more permanent component. Various methods are obviously available. It is common to extract trend inflation through the application of Hodrick-Prescott (HP), linear or band-pass filters. Alternatively, results from market surveys or measures extracted from inflation swaps or bond-based break-even inflation rates are available, but only for relatively short and recent samples of data. In this paper, we employ the *Structural Time Series* (STS) approach proposed by Harvey (1989) to generate a series for trend inflation. The procedure amounts to decomposing the original series into trend, recursive stochastic cycles, and irregular components that vary over time⁵. This way, we extract time-varying measures of expected inflation that for each observation rely only on information available up to the point of estimation. This modelling approach applies a Kalman-filter estimation procedure, in line with a plausible learning process for both the central bank and private agents. Other procedures, like using alternative filtering methods or polynomial trends, did not yield significantly better fit for our model.

Figure 3 plots the estimated Kalman-filter-based trend along with that of a trend computed using the more conventional Hodrick-Prescott filter. We will use them in turn in our subsequent estimates. One can easily notice that the sizeable acceleration of inflation in the sample originates already in the early 1960s, peak in 1980-82, and get back to moderate levels only at the end of the sample.

⁵ For more details, see Hamilton (1994).

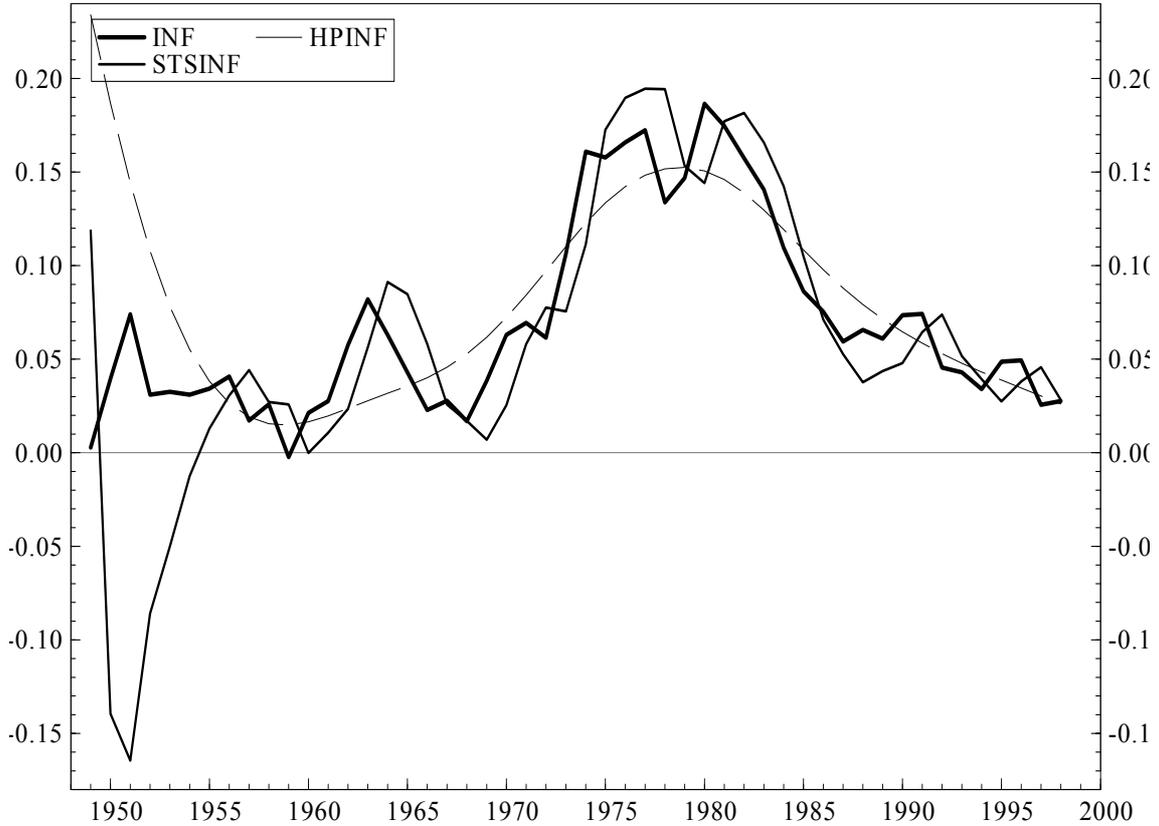


Figure 3, Italy, 1949-1998. Inflation (INF), Hodrick-Prescott (HPINF) and Kalman-filter based (STSINF) measures of trend inflation.

We are now ready to start a joint analysis of output and inflation, in order to reach some conclusion as to the cyclical and structural determinants of the inflationary process in Italy.

Our reference point is a consensus model of inflation and output which blends the original expectation-augmented Phillips curve (Phelps, 1967; Friedman, 1968) with the most recent stylizations on persistence and price/wage rigidity (Woodford, 2003). In detail, a reduced-form representation of the relationship between inflation and output could be:

$$\pi_t = \gamma(y_t - y_t^*) + E_{t-1}\pi_t \quad (1)$$

where $y_t - y_t^*$ denotes the output gap, that is, the difference between the current level of output and its NAIRU or natural level, and $E_{t-1}\pi_t$ the expected inflation rate,

conditional on last period's information. The dependence of current inflation on last period's expectations comes from the application of rational expectations to a structural model with partial price rigidities. This implies that

- (i) unexpected changes in aggregate demand affect both inflation and output;
- (ii) the stickier the prices, the lower ω , which represents Phillips curve's slope.

The literature often discusses the following equation:

$$\pi_t = \gamma(y_t - y_t^*) + \beta E_t \pi_{t+1} \quad (2)$$

This differs from (1), as it links shifts of the curve to changes in current expectations of future inflation. Theoretically, the difference is noticeable; much less so in practical terms, as expected inflation is serially correlated. For this reason, our estimates are based on the following encompassing model:

$$\pi_t = \beta E_t \pi_{t+1} + \omega \pi_{t-1} + \gamma(y_t - y_t^*) + \varepsilon_t, \quad (3)$$

To measure the output gap, we employ again the STS approach. We fit a univariate model for real GDP, and extract time-varying measures of potential output that for each observation rely only on information available up to the point of estimation. As a robustness check, we also tried with a measure of output gap provided by the OECD, and with HP- and band-pass filters, but we found very little differences in the resulting estimates of the Phillips curve.

First, we estimated equation (3) via OLS over the sample 1949-1998. The estimates we obtained, based on either the HP or STS definitions of output gap, are as follows (*t*-values in parentheses):

$$\pi_t = 0.200 E_t \pi_{t+1} + 0.757 \pi_{t-1} - 0.033 (y_t - y_t^*)^{HP} + \hat{\varepsilon}_t$$

(1.21) (5.93) (-0.208)

$$\pi_t = 0.269 E_t \pi_{t+1} + 0.708 \pi_{t-1} - 0.135 (y_t - y_t^*)^{STS} + \hat{\varepsilon}_t$$

(1.61) (5.60) (-1.34)

Overall, the output gap has no statistically significant influence on inflation dynamics. The same applies to forward-looking inflation expectations, even when we re-estimate over variously defined sub samples. The fact that data are dominated by periods of wide output and inflation shocks likely drive the results we obtain. This motivates the use of an approach that takes into account likely changes in the relationship between inflation and real activity over time. In other words, an approach that enables the estimation of a time-varying inflation-output trade-off, and helps in identifying the causal links between observed institutional or behavioural changes and the structural shifts in the curve's coefficients and residual variance.

We therefore computed additional estimates that explicitly allow for time variation in the parameters of the Phillips curve. We employed a time-varying-parameter (TVP) approach to estimate our models. In practice, we allowed the Phillips curve's coefficients to vary over time. What we obtained were estimates of the state vector for each observation in our sample. These estimates can then describe the evolution of the Phillips curve's coefficients over time.

Let us represent the model in a general state-space form (see Harvey, 1989; Kim and Nelson, 1999):

$$\begin{aligned}\pi_t &= c_t + x_t' b_t + e_t \\ b_{t+1} &= d + T' b_t + z_{t+1}\end{aligned}\tag{4}$$

where

$$e_t \approx N(0, \sigma^2), z_t \approx N(0, Q), b_0 \approx N(a_0, \Sigma_0)$$

with x_t containing the explanatory variables.

The first equation in (4) is the measurement or observation equation. It is the classical linear regression model except that the parameter vector b_t (representing the state variables) is allowed to change stochastically according to the transition described in the second equation in (4)⁶. Summing up, this time-varying formulation involves

⁶ We follow the prior distribution proposed by Doan et al. (1984), which assumes that changes in the endogenous variable modelled are so difficult to forecast that in the AR(1) process of the unobserved state vector the coefficient on its lagged value is likely to be near unity, while all other coefficients are assumed to be near zero. The prior distribution is independent across coefficients, so that the MSE of the state vector is a diagonal matrix. Measurement errors and the disturbances to transition equations are assumed to be serially and mutually independent.

forecasting the optimal state vector in each period, based on information available up to the previous period⁷. This way we compute filtered estimates of the parameters and the residuals for each observation in the sample, thus accounting for the potential variation over time of the underlying structural parameters.

Figure 9 plots the times series of the estimated coefficient γ_t in equation (3), that is, the coefficient measuring the sensitivity of current inflation to changes in the output gap⁸. We computed the displayed estimates by using a HP-based measure of inflation expectations and both STS and HP definitions of the output gap.

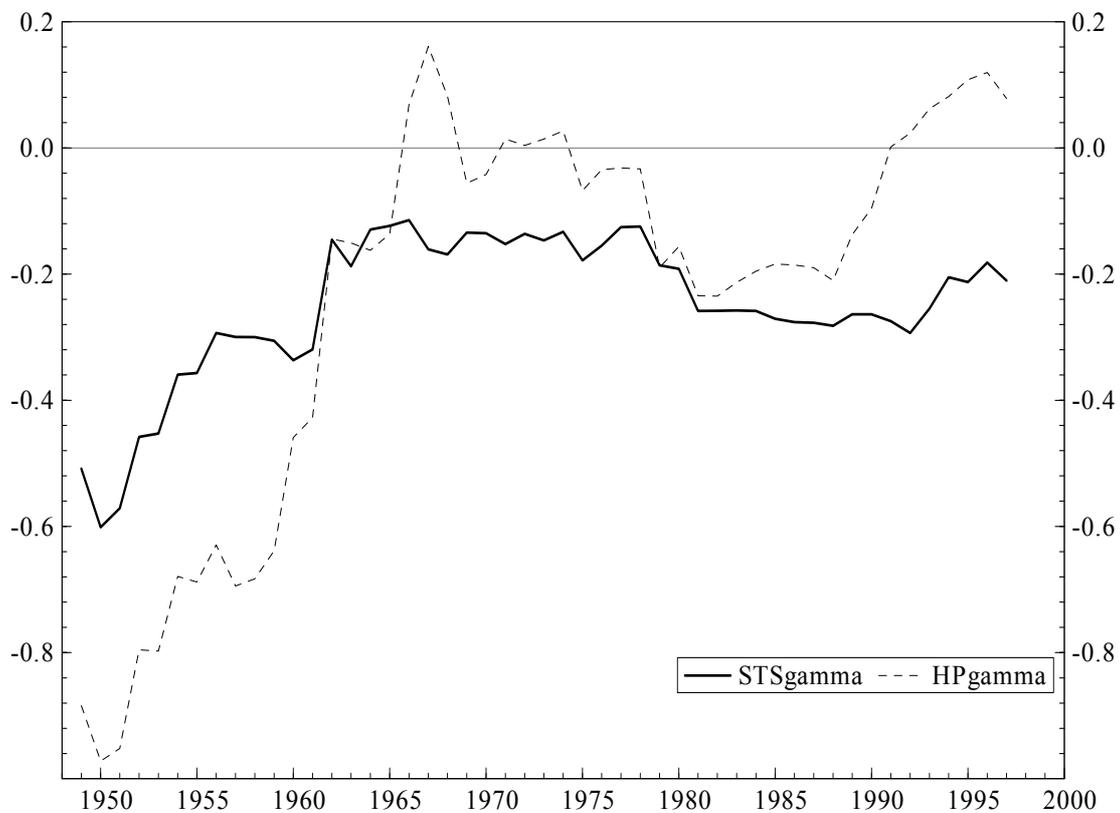


Figure 4, Italy, 1949-1998. Phillips curve, output gap TVP coefficients obtained using Hodrick-Prescott and STS-based measures of the output gap.

The graph substantially confirms the dynamics of the link between inflation and output. If one measures the inflation impact of output changes via standard constant-coefficient

⁷ Under the normality and independence assumptions about the disturbances, the computation of the state vector is obtained via application of the Kalman filter.

⁸ For brevity we do not show here the full results of our TVP estimation, which are available from the authors upon request.

techniques, one finds an insignificant response. This would be the result of a significant but negative feedback for the early part of the sample, and a correlation that was essentially mute for the latter part. The vigorous output developments of the 1950s and early 1960s were basically non-inflationary, as growth in potential output was rapidly shifting the Italian economy's production possibilities, regardless of nominal shocks. This effect died out over time. The constraints imposed on employers and Government by the union power were forbidding and responsible for the structural shift of the Phillips curve towards the upward right, as was recorded by various estimates. (Modigliani-Tarantelli 1976; Bordogna-Provasi, 1979). The validity of the Phillips curve itself was put in question: the increase of inflation and unemployment observed in most OECD countries was the opposite of what one would expect from the curve. Tarantelli (1978) counter argued that the empirical observation of stagflation did not hamper the validity of the decreasing structural relation of the Phillips curve. An increasing relation might be observed if the union achieved a larger wage increase than the market would allow. If the reaction of the monetary policy to the resulting cost push inflation is a successful deflation, an increasing relation between the rate of growth of monetary wages and the unemployment rate may well exist. Modigliani and Tarantelli (1976) showed that starting from 1968, as a result of the constant change in industrial relations regime that we have described above and of the political conflict, the Phillips curve shifted upward and became steeper every contract renewal.

5. Comparing Italy with the USA and UK

It is now even more interesting to compare our findings for Italy with what one can obtain on similar data and sample spans for other countries using the same methodology. Therefore, we extended the analysis to the USA and UK. Figure 5 groups the annual inflation rates (all based on the price deflator of national income) for the three countries. Italian inflation easily emerges as having the highest mean and volatility. UK and Italy differ sharply from the US, as they had significantly higher inflation throughout the 1970s and 1980s⁹.

⁹ Another interesting finding is that Italian and UK inflation rates have similar persistence levels, both far higher than for the US.

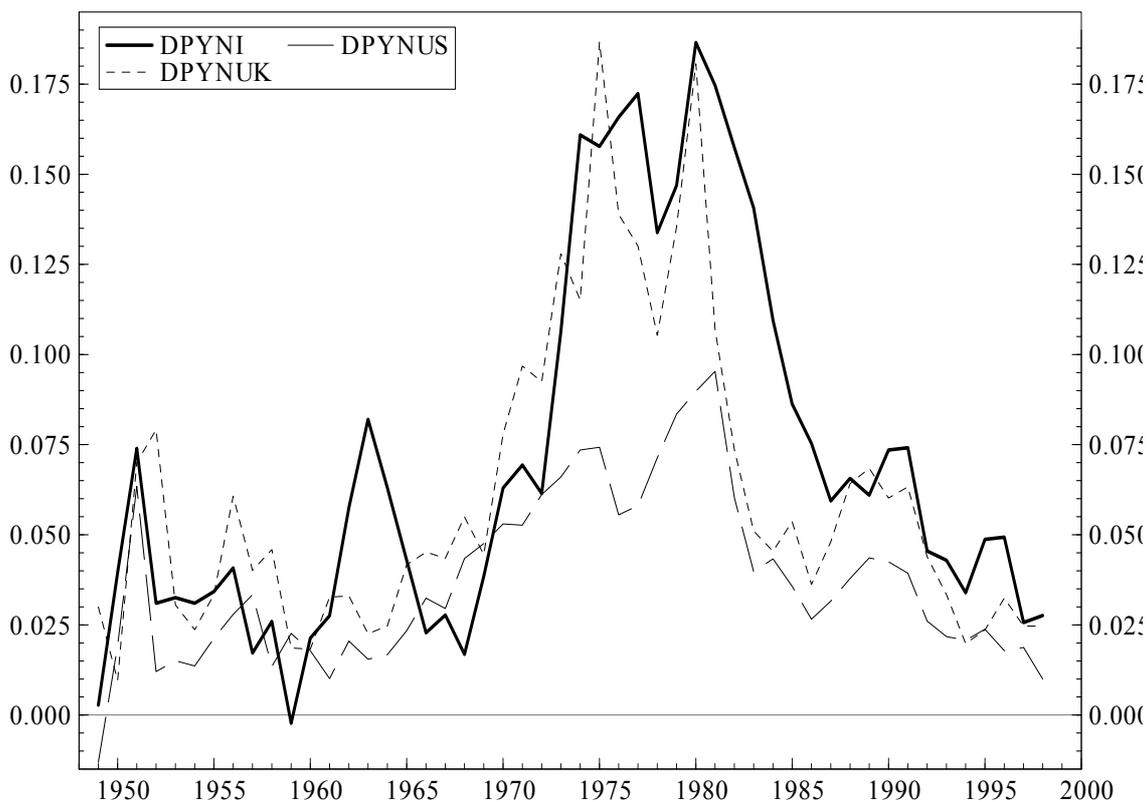


Figure 5, USA, UK and Italy, 1949-1998. Inflation rates.

Turning to a comparison of the inflation-output relationships across the three countries, Table 3 contains the results for the standard New Keynesian Phillips Curve specification¹⁰.

$E_t \pi_{t+1}$	π_{t-1}	$(y_t - y_t^*)$
USA		
0.707 (6.02)	0.302 (2.67)	0.127 (2.16)
UK		
0.649 (4.90)	0.369 (2.98)	0.179 (1.36)
Italy		
0.200 (1.21)	0.757 (5.93)	-0.033 (-0.208)

¹⁰ For these estimates we measured the output gap using a HP-based series for potential output. Results do not qualitatively differ with the STS approach.

Table 3. USA, UK and Italy, 1949-1998. New Keynesian Phillips Curve, coefficient estimates and t-values.

Only for the US our constant-coefficient estimates portray an inflation-output trade-off in line with the conventional NKPC. Again, Italy stands out as the only country in which even inflation expectations do not appear to drive actual inflation.

Finally, to get a glimpse of the evolution of the inflation-output relationship, we also estimated TVP models for UK and the US. Figure 6 plots the output gap coefficients computed using the TVP methodology we outlined above. The dominant feature is that UK and Italy have seen similar falls in the size of the output gap coefficient, although in the UK the long-run relationship seems to have held up. In the US, the sensitivity of inflation to output developments both more sizeable and stable, with only temporary breaks during the 1970s' stagflation. These findings broadly confirm in a cross-section dimension that the standard trade-off between inflation and output growth emerges only during periods of low inflation and limited macroeconomic volatility.

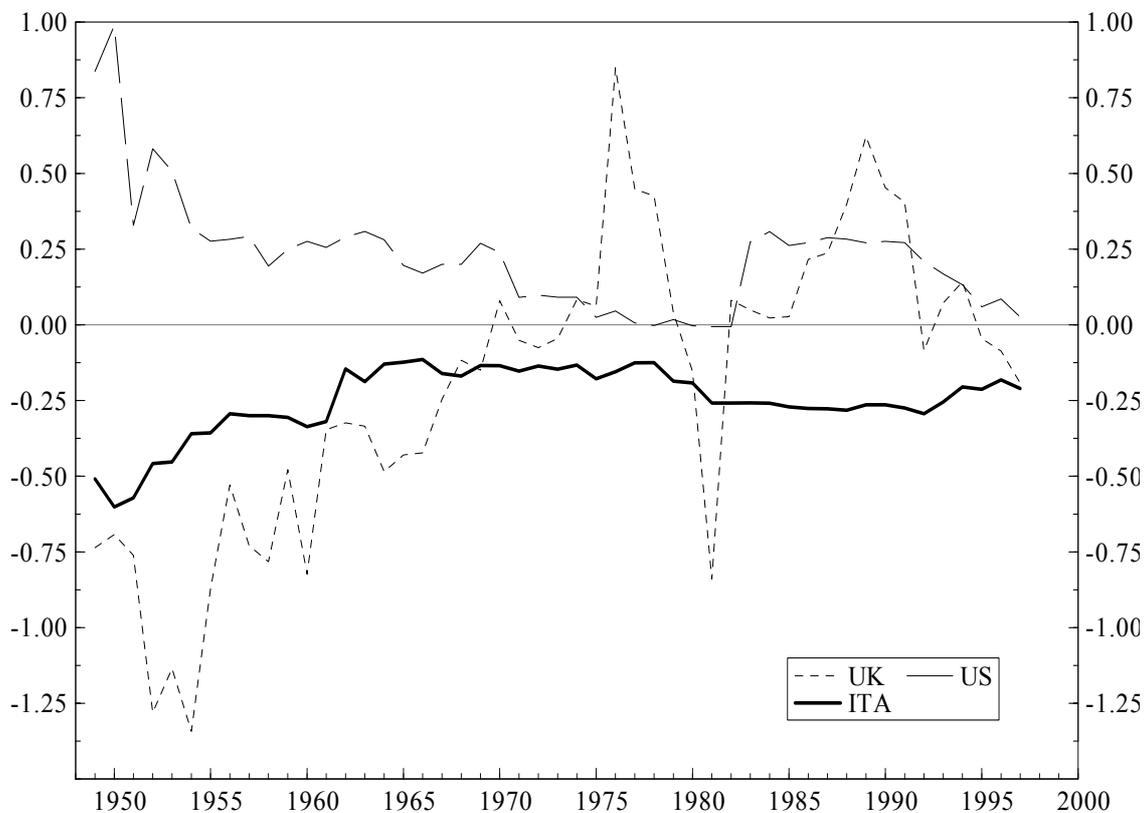


Figure 6, USA, UK and Italy, 1949-1998. Phillips curve, output gap TVP coefficients obtained using STS-based measures of the output gap.

6. Discussion and concluding remarks

In the seventies, Italy and UK occupied the most uncomfortable position in the Calmors-Driffils curve (Bordogna, 2003).

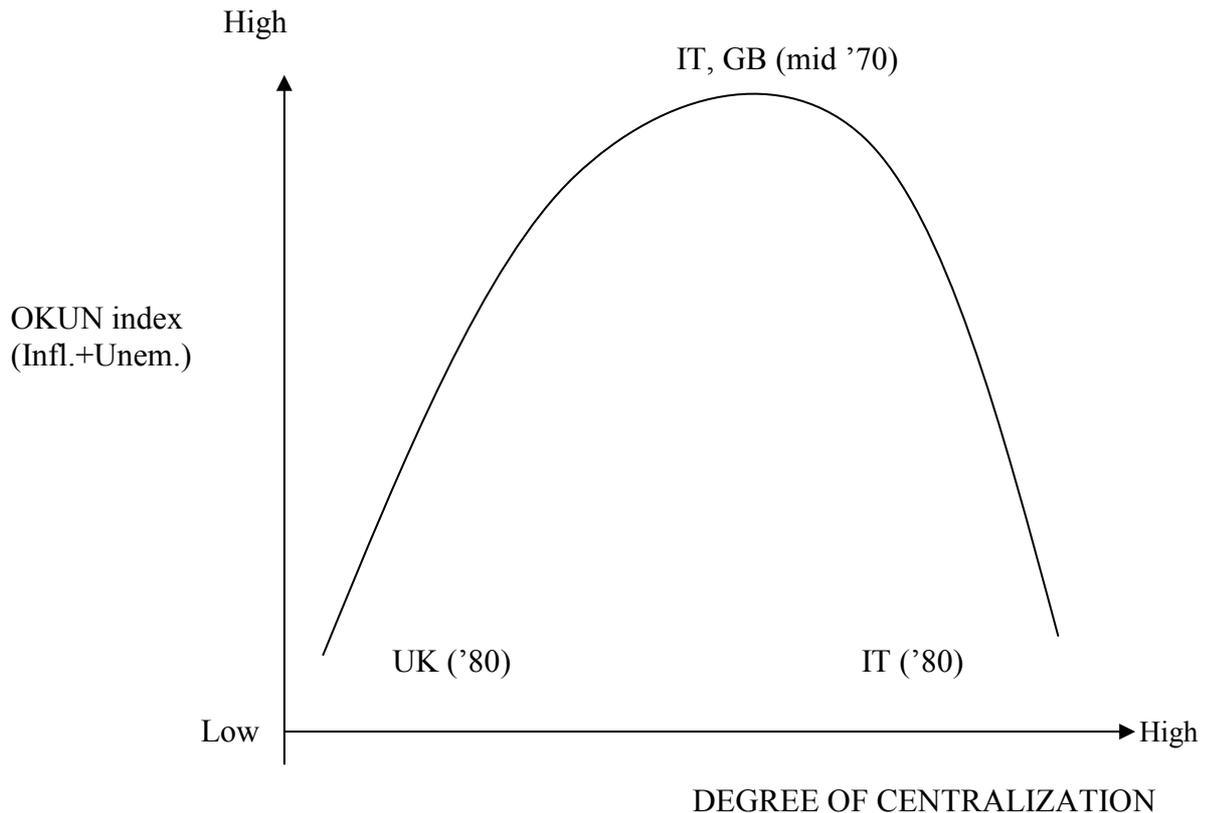


Fig. 7. Degree of centralization and misery index: Italy and UK (1975-85)

The curve relates Okun misery index (inflation+unemployment) with the degree of centralization of the wage setting system, highly decentralized to the left, highly centralized to the right. The two countries were in the mid-seventies at the top of the curve but in the '80s they followed two opposite routes to defeat inflation: the UK moved to the bottom left by letting market regulation work, whereas Italy moved (somewhat) to the bottom right through political regulation and further centralization (see Figure 7 from Bordogna 2003). We feel that the bulk of this paper has effectively pinned down the automatic indexation mechanism on which the protection of real wages was based as the most likely explanation for the Italian “anomaly”.

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